Butcher Transistor
Testor

10A/10AC-1/10CD/10E/10-2

CALIBRATION

DATE 2247

(A)

TEST TYPE: Calibration

ITEM IDENT.: Bircher Model 70A

SERIAL NO.: 2247 OTHER: Sig C 1848-1

DATE: 1 Dec 1967

PROJECT:

TECH.: Reeves CAL 29

DL NO.:

PAGE 1 OF 1

RESULTS

IN SPECS ✓

~~OUT OF SPECS~~

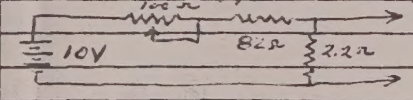
Check X'mer Voltages at 117V Line. Voltages to be ± 5%, No Load, Lower Adjust Max CW.

T103	Pin 10 to 9	6.5VAC	6.93
	8	13.5VAC	14.49
	7	26 VAC	29.229
	6	85VAC	89.779
	5	250 VAC	261.03
	4	750VAC	778.89
T102	Pin 8 to 6	25.2VAC	26.99
	Pin 19(+) to 20(-)	+17VDC. (AT Plug Pins)	+18.799

Protection Ckt - Measure T101 Term 13 to Plug Pin 14 For Sense Line Overload Trip between 4 to 5.5VDC 5.325 V
(Connect Pwr Supply To Sense points, -13+14, and increase voltage slowly with Test button depressed until Reset Light Lites)

T101	Pin 3 to 2	360VAC	403
	9 to 11	12.6 VAC	14.17
	6 to 8	12.6VAC	14.14

Meter Cal - Upper (R105) + Lower (R104) As per 4.7 in IB.



Adjusted.

Equipment Used:-

Cimron 730C A + C701A Plug In Digital Voltmeter
H Lab C206R Pwr Supply
DC Meter 0 to 200 ua

THE BIRTCHER CORPORATION

CHECK OUT PROCEDURE

SPEC. NO. _____
DATE 12-17-64
REV DATE 12-17-64
APPROVED _____

MODEL 10 A

EQUIPMENT NEEDED

1. ½% lab VOM.
2. Dual Channel scope Tektronix Type 503 or 531A with Type CA plug-in.
3. 3' extender cable.
4. Calibrated test transistors.
5. Transistor test adapter-power.
6. Transistor test adapter-small signal.

VISUAL INSPECTION

1. Carefully inspect all solder connections for proper shape, evidence of crystalization ("cold" joint), rosin residue or other deposits, and frayed or damaged wire insulation. Clean or rework as needed.

2. Where used, check printed circuit boards for proper soldering, fractures of base material, and scratches on foil. Scratches may be bridged with solder, but care must be exercised in maintaining even solder flow on foil.

3. Check operation of controls for freeness of movement or proper detent action on switches. Make certain the dress panel is not bent or scratched.

4. Inspect general chassis area for neatness of harnesses and wiring, stray sleeving pieces, and rosin or other residue around connections. Check sleeving, where used, for proper size, position, and damage. Remove any metallic scrap found, paying close attention to evidence of metal particles around switches.

5. Check hardware and mounting devices for scratches and burrs, tightness and proper size. Pay especial attention to insulating washer placement. Observe appearance of rubber grommets and mounts; they should be smooth and show no cracking.

PULSE GENERATOR

1. Place all controls and switches in counter-clockwise position.
2. Place POLARITY switch in PNP position.
3. Connect 10 A to MODEL 70 basic unit with extender cable.
4. Connect MODEL 70 to 115 with isolating plug.

INSTRUMENT SHOP

PULSE GENERATOR (Cont.)

5. Connect scope to 115 VAC with isolating plug.
6. Remove all tubes except V202 and V203.
7. Connect scope ground to term 5(R254)* on PULSE GENERATOR PC board.
8. Connect Channel A scope input to term 4(R248)*.
9. Connect Channel B scope input to emitter of Q205(R258)*.
10. Scope Setting:

Time/cm:	5 m sec/CM
Volts/cm:	5 v/cm
Trigger Slope:	Line +
Trigger Mode:	Auto.
AC-DC	AC
Input Channel A:	+
Input Channel B:	-
Preamp Mode:	Added algebraically

11. Set test switch in RESET position (MODEL 70).
12. Turn power ON.
13. Adjust trace to center of CRT.
14. Adjust SYNC control (R246) for pulse output every 8.3 millisec. Seal with Glyptol.
15. Set time/cm to 20 μsec and Trigger Slope Int, negative.
16. Adjust Pulse Width Control (R252) for a current pulse as shown in Figure I. Seal with Glyptol.

EMITTER CURRENT SUPPLY

1. Connect scope ground to chassis ground.
2. Connect scope Channel A input to emitter terminal. See Fig 2 for Scope Settings
3. Set dual trace amplifier mode switch to Channel A. Adjust trace to ~~center~~ Left of CRT.
4. Depress test switch.
5. Increase I_c adjust control (upper, MODEL 70).
6. With polarity switch in PNP position, pulse output to be positive. (Fig. 2)

*To resistor lead nearest edge of PC board.

MODEL 10A

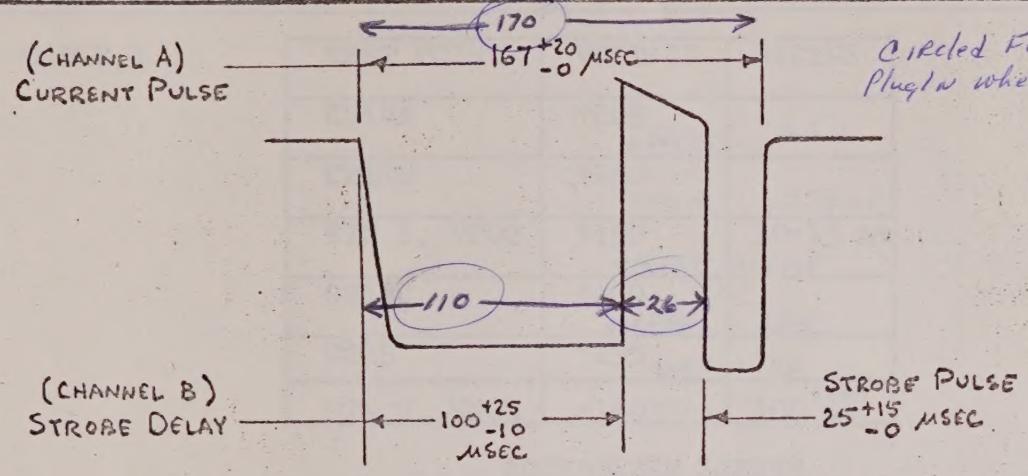


Figure 1

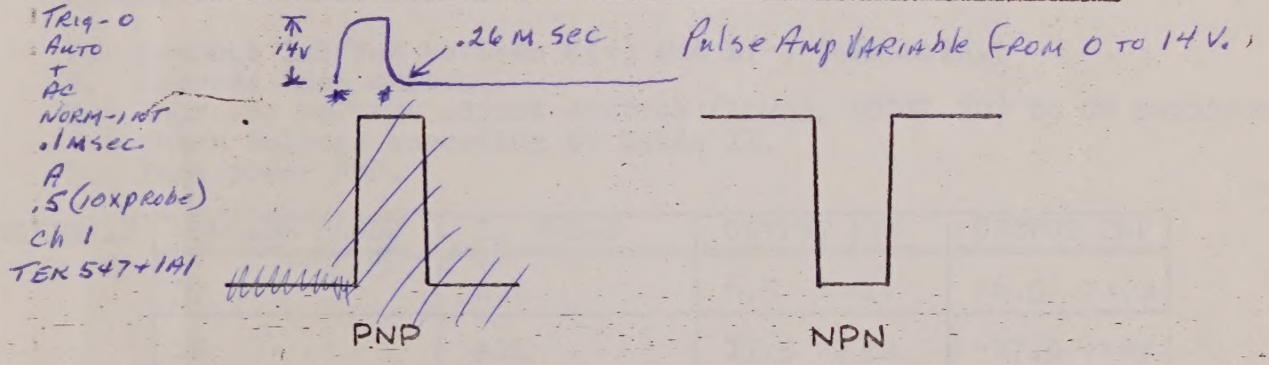


Figure 2

7. With Polarity switch in NPN position, pulse output to be negative (Figure 2). & TRIG Slope —.
8. Turn I_c range switch to all ranges and observe pulse output. Should be no change
9. Disconnect scope.
10. Turn I_c adjust control counter-clockwise.

AUXILIARY POWER SUPPLY

1. Connect lab. VOM common to ground.
2. Check the voltages according to Table I.

MODEL 10 A

TABLE I

TEST POINT	VOLTAGE	RIPPLE
C214A	+225 +245.75	1.5 V
C214B	+180 +182.19	.035 4V
PIN 1, V202	+150 +151.34	10-15 mv 5.1 MV
C214C	+150 +151.34	1 MV
C215	-235 -245.7	.7V
PIN 7, V203	-150 -157.5	100 mv 47 MV

ACCEPTABLE LIMITS
±7% WITH 115 VAC LINE VOLTAGE

COLLECTOR VOLTAGE SUPPLY

1. Connect lab VOM between C(+) and E(-) terminals.
2. Depress test switch.
3. Increase voltage adjust control (lower, MODEL 70) to CW position.
4. Check voltage according to Table II.
5. Turn power OFF.

TABLE II

VOLTAGE RANGE	I_C RANGE	OUTPUT NPN	OUTPUT PNP
3	All	6.5 7.465	-6.5 -7.343
10	All	17.5 17.32	-17.5 -17.43
30	To 10 amps	37V 37.64	-37 -37.85
	30	17V 18.00	-17 -16.05
100	To 3 amps	125V 115.14	-125 -115.69
	10 amps	37V 35.579	-37 -35.74
	30 amps	17V 18.379	-17 -18.454

ACCEPTABLE LIMITS
±7% WITH 115 VAC LINE VOLTAGE

COLLECTOR VOLTAGE AMPLIFIER

1. Insert V204 and V205, Plug In PwR XSTR Test Adaptor.
2. Set I_C range switch to 1 ma position.
3. Turn power ON.
4. Adjust voltage zero control for zero indication on voltage meter with test switch in RESET position.
5. Depress TEST switch.
6. Turn voltage ADJUST control for 100V indication on VOM.

7. Adjust R316 for full scale indication on voltage meter (lower, Model 70). Seal with Glyptol.
8. Check voltages according to Table III.

TABLE III

VOLTAGE RANGE	SETTING	VOM NPN	VOM PNP
100	100	100 OK	-100 OK
	50	50 OK	-50 OK
30	30	30 OK	-30 OK
10	10	10 OK	-10 OK
	8	8 OK	-8 OK
	6	6 OK	-6 OK
	4	4 OK	-4 OK
	2	2 OK	-2 OK
3	2.5	2.5 OK	-2.5 OK

ACCEPTABLE MEASUREMENTS
± 2% OF FULL SCALE

COLLECTOR CURRENT AMPLIFIER

1. Set lower ADJUST control counter-clockwise.
2. Set TEST switch to RESET position.
3. Set POLARITY switch to PNP position.
4. Set I_c range switch to 1 ma position.
5. Insert V206, V207.
6. Short terminal E and C of power transistor test adapter.
7. Connect scope channel A from ground (on S202) to common terminal S202 Deck 2.
8. Adjust current zero control for zero indication on CURRENT METER.
9. Depress test switch.
10. Increase upper adjust control for 1 volt positive pulse amplitude on scope. (.2V/cm).
11. Adjust R316 for full scale indication on current meter. Seal with Glyptol.
12. Check for output on all I_c ranges.
13. Connect 10 ohm precision resistor between emitter and collector.
14. Connect + scope input to E and - scope input to C.
15. Read pulse current according to Table IV.

MODEL 10A

TABLE IV.

RESISTANCE E-C	I_c RANGE I	I_c SETTING	VOLTAGE
10 Ω	1	1	.01 (10MV) 12MV
	3	3	.03 (30MV) 34MV
	10	10	.1 .115
	30 ma	30 ma	.3 .34
	100	100	1 1.15
.1 Ω	1 amp	1 amp	.1
	3	2	.2
	10	5	.5
	30	15	1.5

ACCEPTABLE LIMITS ± 2% OF FULL SCALE ON I_c METER

TRIP CIRCUIT CHECK

1. Place test switch in reset position.
2. Short emitter to collector.
3. Set I_c range switch on 1 ma range.
4. Turn lower adjust control counter-clockwise. (Upper Current Control CCW)
5. Set voltage range switch on 10 volt range.
6. Depress test switch.
7. Increase voltage adjust control until trip circuit fires.

NOTE: Acceptable range .1-.3 ma. Remove E-C Short.

BETA NULL DETECTOR

1. Connect Model 70 to 115 VAC with isolating plug removed.
2. Set test switch to reset position. (All controls CCW)
3. Insert V201, V208, V209, and ~~V201~~. (Meter Removed)
4. Zero null meter with h_{fe} zero control.
5. Check zero as h_{fe} dial is varied from 0-100 with h_{fe} RANGE switch in X10 position (max. deviation to be 1 div. on null meter).
6. Jumper S202 as shown in Figure 3. Set Upper Range for 1 MA.
7. Adjust h_{fe} dial for null at 10 on dial and X1; 1 on dial and X10. Acceptable deviation ± .5 division. (With Test Button Depressed)
8. Check h_{fe} reading on all I_c ranges.

OPERATIONAL CHECK

1. Insert test module in Model 70 basic unit.
2. Check Beta of calibrated test transistors.

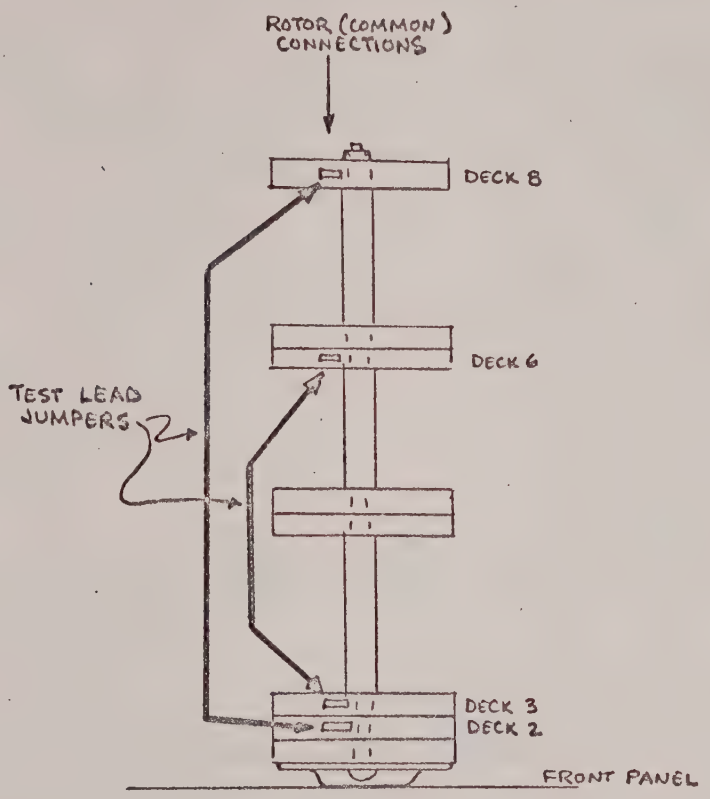


Figure 3
Top View, Current Range Switch

MECHANICAL ADJUSTMENT

Adjust module latch per latch adjustment instruction B5534.

When complete, clean unit inspection block, mark schematic revision letter on record card. On returned goods, note repair work and calibration done on RGM.

THE BIRTCHER CORPORATION

CHECK OUT PROCEDURE

SPEC. NO. _____
DATE 12-17-64
REV DATE _____
APPROVED _____

MODEL 10 AC-1

EQUIPMENT NEEDED

1. Birtcher MODEL 70 basic unit.
2. Extender cable with Amphenol 57-10500 connectors.
3. ½% lab type multimeter.
4. 100 mv/div oscilloscope.
5. 2 Resistance Decades 1Ω to 999K - ½% Accy.
6. Calibrated test transistors.

VISUAL INSPECTION

1. Carefully inspect all solder connections for proper shape, evidence of crystalization ("cold" joint), rosin residue or other deposits, and frayed or damaged wire insulation. Clean or rework as needed.
2. Where used, check printed circuit boards for proper soldering, fractures of base material, and scratches on foil. Scratches may be bridged with solder, but care must be exercised in maintaining even solder flow on foil.
3. Check operation of controls for freeness of movement or proper detent action on switches. Make certain the dress panel is not bent or scratched.
4. Inspect general chassis area for neatness of harnesses and wiring, stray sleeving pieces, and rosin or other residue around connections. Check sleeving, where used, for proper size, position, and damage. Remove any metallic scrap found, paying close attention to evidence of metal particles around switches.
5. Check hardware and mounting devices for scratches and burrs, tightness, and proper size. Pay especial attention to insulating washer placement. Observe appearance of rubber grommets and mounts; they should be smooth and show no cracking.

INSTRUMENT SHOP

MODEL 10 AC-1

INITIAL TURN ON

1. Place EMITTER CURRENT switch in clockwise position, No Transistor Test J19 installed.
2. Place all other switches and controls in their counter-clockwise position.
3. Place POLARITY switch in PNP position.
4. Connect Model 10 AC module to MODEL 70 basic unit by means of the extender cable.
5. Connect voltmeter from "E"(+) to "C"(-) jacks on the basic unit.
6. Turn POWER switch on MODEL 70 ON.
7. Depress RESET switch to TEST position.

NOTE: All the following measurements should be 1%.

COLLECTOR VOLTAGE SWITCH

1. Adjust lower ADJUST knob on MODEL 70 until lower meter on Model 70 reads full scale. Voltmeter should read 3 volts DC. 2.9299
2. Switch POLARITY switch to NPN. Polarity at test jacks should reverse, but lower meter on MODEL 70 should remain at full scale.
3. Return POLARITY switch to PNP position.
4. Repeat step 1 for the 10 and 30 volt ranges on the COLLECTOR VOLTAGE switch. Voltmeter readings should be 10 and 30 volts respectively for full scale readings on lower meter. 9.9349 30.003
5. Return lower ADJUST knob to its counter-clockwise position.
6. Return COLLECTOR VOLTAGE switch to its counter-clockwise position.

EMITTER CURRENT SWITCH

1. Place EMITTER CURRENT switch in counter-clockwise position.
2. Connect current meter from "E"(+) to "B"(-) jacks on MODEL 70, Press Test Button.

EMITTER CURRENT SWITCH (Cont.)

3. Adjust upper ADJUST knob for full scale readings on upper meter on Model 70. Current meter should read .1 ma.

4. Switch POLARITY switch to the NPN position. Current through current meter should reverse, but upper meter should still read full scale.

5. Repeat Step 1 for .3, 1, 3, 10, 30 and 100 ma ranges on the EMITTER CURRENT switch. Current meter should read .3, 1, 3, 10, 30 and 100 ma respectively for full scale readings on upper meter on MODEL 70.

6. Return EMITTER CURRENT switch to its counter-clockwise position.

7. Return upper ADJUST knob to its counter-clockwise position.

1000 CYCLE OSCILLATOR

1. Place oscilloscope leads from pin 3 to pin 4 of T201. A clean sine wave at 1000 cycles ±10% should be adjustable from 0 volts to about 1.2 volts p-p by means of CAL control (R-245) located on the front panel of the module. At Cal, 1.3 Vpp with .01 V ripple

TUNED AC VOLTMETER

1. Set CAL control so AC meter indicates .8 on upper scale.

2. Tune voltmeter by adjusting C219 for a maximum reading on the AC meter.

3. Adjust CAL until AC meter reads full scale.

4. Retouch C219 for maximum reading on AC meter.

AC RANGE SWITCH

1. Connect ~~10~~ 9Ω ½% resistance between "E" and "B" jacks on MODEL 70; Set FUNCTION switch to hib. Don't Press Test.

2. Switch AC RANGE to the 10 position. M201 should read full scale.

9Ω = 9.3

AC RANGE SWITCH (Cont.)

3. Short "E" and "B" jacks on MODEL 70. M201 should drop to zero (less than one division above zero is acceptable).

4. Repeat Steps 1, 2 and 3 for the 30, 100, 300 and 1000 positions using ~~30~~, ~~100~~, ~~300~~ and ~~1000~~ ohm ½% resistances. The AC meter should read 30, 99.0, 291 and 909±3% respectively. When "E" and "B" jacks are shorted in these switch positions, the AC meter should drop to zero.

Ω = Read
29 = 29.6
98 = FSD
300 = FSD
1000 = 940

FUNCTION SWITCH

1. Place all controls and switches in the counter-clockwise position.

2. Set AC RANGE switch in the 10 position.

3. Since h_{ib} position was checked in conjunction with the AC RANGE switch, set FUNCTION switch to h_{rb} X 10^{-4} position.

4. Place a ~~10~~Ω ½% resistance from "E" to "B" jacks on Model 70 and a ~~10~~K ½% resistance from "E" to "C" jacks. The AC meter should read full scale. with Test Pressed.
9 or 8999

5. Switch FUNCTION switch to h_{ob} X 10^{-7} position.

6. Place a 1 Megohm ½% resistor between "B" and "C" jacks on MODEL 70. The AC meter should read full scale. Press Test.
1M = 11.25 on 30 Range

7. Switch FUNCTION switch to the h_{ie} position.

8. Place a ~~100~~Ω ½% resistance between "E" and "B" jacks on MODEL 70. The AC meter should read full scale. 96Ω = FSD

9. Depress X10 button. AC meter should read 1/10 full scale.

10. Switch FUNCTION switch to h_{re} X 10^{-4} position.

11. Place ~~10~~Ω ½% resistance from "E" to "B" on MODEL 70.
10Ω — 13,300

12. Place ~~10~~K ½% resistance from "B" to "C" jacks on MODEL 70. The AC meter should read full scale. FSD
Press Test

13. Switch FUNCTION switch to h_{oe} X 10^{-6} position.

MODEL 10 AC-1

FUNCTION SWITCH (Cont.)

14. Place a ~~10K~~ precision resistor between "E" and "C" jacks on the MODEL 70. The AC meter should read full scale. PRESS TEST SWITCH. METER READS 105 ON 300 RANGE WITH 10K; F.S. ON 10 RANGE WITH 106 OHMS.
15. Switch FUNCTION switch to h_{fe} position.
16. Short "B" and "C" jacks on MODEL 70. M201 should read 1 (1/10 full scale) on the 10 range.

NOTE: Omit Steps 7 through 14 on units with serial numbers below: 10 AC-1-50.

OPERATION TEST

1. Check all parameters of a calibrated test transistor at 75°F. Measurements should be within ±2%.

MECHANICAL ADJUSTMENT

1. Adjust module latch per LATCH adjustment instructions B5534.

When complete, sign unit inspection block; mark schematic revision letter on record card. On returned goods, note repair work and calibration done on RGM.

THE BIRTCHER CORPORATION

SPEC. NO. _____
DATE 10-25-65
REV DATE _____
APPROVED L.H. Anderson

CHECKOUT PROCEDURE 10CD MODULE

EQUIPMENT NEEDED

1. Birtcher Model 70 Basic Unit
2. Birtcher type 5536 module connector cable.
3. Continuity tester.
4. DC voltmeter 2% accuracy. Ranges to 5000V. Triplet 630-APL or equivalent.
5. Digital voltmeter 0.1% accuracy. 1V to 1000V range.
6. Precision DC milliammeter 1 ma full-scale, 1/2% accuracy. Simpson Model 1702, 1703, or equivalent.
7. Precision resistor, 1000 megohms, ±1%.
8. Power Resistor, 100K 10W, 10%.
9. Resistor decade 1 Ω to 1 meg, 1%.

VISUAL INSPECTION

1. Carefully inspect all solder connections for proper shape, evidence of crystallization ("cold" joint), rosin residue or other deposits, and frayed or damaged wire insulation.
2. Where used, check printed circuit boards for proper soldering, fractures of base material, and scratches on foil. Scratches may be bridged with solder, but care must be exercised in maintaining even solder flow on foil.
3. Check operation of controls for freeness of movement or proper detent action on switches. Make certain the dress panel is not bent or scratched.

INSTRUMENT SHOP

4. Inspect general chassis area for neatness of harnesses and wiring, stray sleeving pieces, and rosin or other residue around connections. Check sleeving, where used, for proper size, position, and damage. Remove any metallic scrap found, paying close attention to evidence of metal particles around switches.
5. Check hardware and mounting devices for scratches and burrs, tightness and proper size. Pay especial attention to insulating washer placement. Observe appearance of rubber grommets and mounts; they should be smooth and show no cracking.

CAUTION!

When making the following tests, HIGH VOLTAGES are present. These voltages (UP TO 1300V DC) COULD BE FATAL!

AUXILLARY POWER SUPPLY

NOTE: Auxillary power supply checkout to be made with all tubes removed from the test module except voltage regulators V205 and V206.

Don't Remove PAGE 3 missing

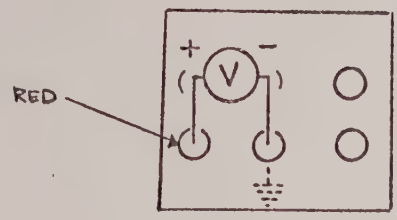
1. Set front panel controls as follows:

ADJUST CONTROL	CCW
POWER SWITCH	ON

Check the following voltages with respect to ground:

PAGE 3 missing - Req. Tubes

6. Connect external D.V.M. to test jacks as shown in Figure 1.



Plug In Connections

7. Depress TEST switch.
8. Turn UPPER ADJUST control CW until F.S. indication is observed on Model 70 UPPER METER. (Lower Adj. CW)
9. D.V.M. should indicate between 9.90 and 10.10V.
10. Check the following voltage ranges with DVM as in Steps 9 and 11.

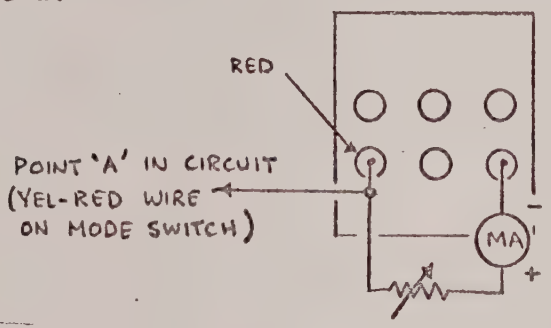
METER F.S.	DVM MIN.	MAX.
30V	29.7	30.3
100V	99.0	101.0
300	297	303
1000	990	1010

NOTE: With the meter set as in Step 11, F.S. indication should be within 1% when VOLTAGE RANGE switch is switched to other range without re-adjustment of UPPER ADJUST control.

11. With output set to 1000V, connect 100K, 10W resistor across output terminals. Voltage drop to be less than 10V.
12. Release TEST switch.
13. Reset front panel controls as follows:

UPPER ADJUST CONTROL	CCW
TEST SUPPLY MODE	BREAKDOWN
CURRENT RANGE	1 MA

14. Connect external current meters and resistor decade as shown in Figure 2.



15. External current meter to 1 MA F.S. range.
16. Set external resistor decade to 0 ohms.
17. Depress TEST switch.
18. Turn UPPER ADJUST control CW until 1 ma is indicated on external current meter.
19. Check voltmeter indication with following external resistance value:

EXTERNAL RESISTANCE	VOLTAGE RANGE
1K	1V
10K	10V
100K	100V
1meg	1000V

VOLTAGE RANGE
10
10 - 30
100 - 300
1000

NOTE: Current indication should remain constant within 1% with different external resistances without re-adjustment of UPPER ADJUST control.

CURRENT AMPLIFIER ZERO

1. Install the following components:

   V207

   V208

   X201

2. Set front panel controls as follows:

UPPER ADJUST CONTROL	CCW
LOWER ADJUST CONTROL	CW
TEST SUPPLY MODE	BREAKDOWN
VOLTAGE RANGE	10V
CURRENT RANGE	1 MA

3. Turn power on and allow 5 minutes warmup.
4. Measure filament voltage V207 12 to 13V.
5. Short pin 6 V208 to ground.
6. ZERO lower meter on Model 70 with R256.

CURRENT SWITCH MECHANICAL ADJUSTMENT

1. Install the module without plug-in in the Model 70 and set the controls as follows:

TEST SUPPLY MODE	LEAKAGE
VOLTAGE RANGE	10V
CURRENT RANGE	10 MA
UPPER ADJUST	FULL CCW
LOWER ADJUST	FULL CW
TEST SWITCH	RESET

2. Turn on the Model 70 and allow at least five minutes warm-up.
3. Check the LOWER METER zero; if not zeroed, repeat steps 1 through 6 of the CURRENT AMPLIFIER and CURRENT RANGE SWITCH section.
4. Rotate the CURRENT RANGE switch through each range, observing the LOWER METER zero indication. Proper operation is indicated by a slight rise in needle position at about the 100 nanoamp range with return to zero at 100 picoamps; the increse in zero shall not exceed ±1% of full scale ±5 picoamps.
5. If the zero position exceeds the limits of Step 4, the CURRENT ZERO switch must be rotated physically. There is no set procedure for finding the correct position; the cause of off-zero conditions is slight variations of temperature along the switch connections. The temperature differences cause different thermal E.M.F.'s among the connections and these variations are affected by minute changes in convective cooling airflow. The airflow is affected by different wiring placement.

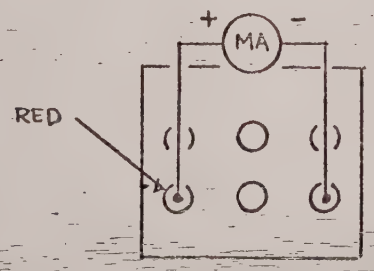
6. When making checks of switch positions, allow sufficient time for the chassis area around the CURRENT RANGE switch to stabilize thermally.

CURRENT AMPLIFIER CALIBRATION

1. Set the controls as follows

UPPER ADJUST	FULL CCW
LOWER ADJUST	FULL CW
TEST SUPPLY MODE	BREAKDOWN
VOLTAGE RANGE	10V
CURRENT RANGE	1 ma

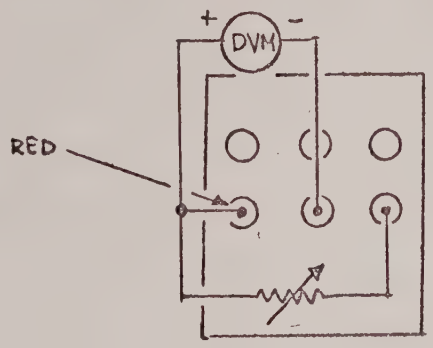
2. Turn power on and allow five minutes warm-up.
3. Connect external current meter as shown in Figure 3.



4. Set external current meter range to 1 ma.
5. Depress TEST switch and adjust for exactly 1 ma indication on external current meter.
6. Adjust R261 for F.S. indication on LOWER METER, model 70.
7. Reset the following front panel controls:

TEST SUPPLY MODE	LEAKAGE
VOLTAGE RANGE SWITCH	10V

8. Connect external resistance and DVM as shown in Figure 4.



9. With TEST switch depressed, set UPPER ADJUST control for voltages given below with indicated external resistance at each current range:

CURRENT RANGE SWITCH	EXTERNAL RESISTANCE	VOLTAGE SET
100 pa	1000 megs	0.1 V
1 na	1000 megs	0.1 V
10 na	1000 megs	10 V
100 na	100 megs	10 V
1 μa	10 M	10 V
10 μa	1 M	10 V
100 μa	100 K	10 V
1 ma	10 K	10 V
10 ma	1 K	10 V

TRIP CIRCUIT

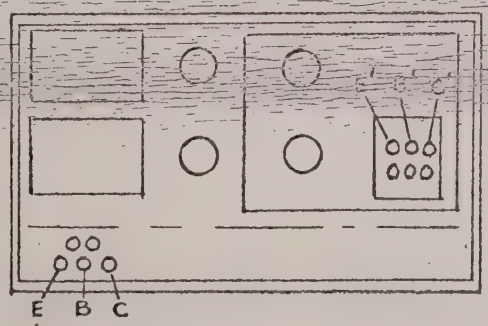
1. Set front panel controls as follows:

UPPER ADJUST	CCW
LOWER ADJUST	CW
TEST SUPPLY MODE	LEAKAGE
VOLTAGE RANGE	10V
CURRENT RANGE	1 MA

2. Connect external resistor decade and current meter as shown in Figure 2.
3. Set external resistor to 5K.
4. Set external current meter to 3 MA FS range.
5. Depress TEST switch and turn UPPER ADJUST control slowly CW until trip circuit is triggered. External current meter should indicate between 3 and 4 ma just prior to tripping.

BINDING POST CONNECTION

1. Turn power off.
2. Check continuity between points E'-E, B'-B, C'-C, G' and case as shown in Figure 6.



3. Check for shorts between E'-B', B'-C', C'-E'.

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CHECK OUT PROCEDURE

SPEC. NO. _____
DATE 3-4-65
REV DATE _____
APPROVED _____

MODEL 10-E

EQUIPMENT NEEDED

1. Laboratory DC voltmeter to read 1.00 volt, accuracy ± 0.5% or better. Simpson Model 1700 or equivalent.
2. Laboratory DC microammeter to read 30 to 100 u AMP, accuracy ± 0.5% or better. Simpson model 1703 or equivalent.
3. Triplett model 630-PL multimeter.
4. Beta, Leakage, Saturation, and Breakdown Program Cards.
5. Power Transistor Test Adapter, B5529.
6. Module extender cable.
7. Calibrated test transistors.

VISUAL INSPECTION

1. Carefully inspect all solder connections for proper shape, evidence of crystallization ("cold" joint), rosin residue or other deposits, and frayed or damaged wire insulation. Clean or rework as needed.

2. Where used, check printed circuit boards for proper soldering, fractures of base material, and scratches on foil. Scratches may be bridged with solder, but care must be exercised in maintaining even solder flow on foil.

3. Check operation of controls for freeness of movement or proper detent action on switches. Make certain the dress panel is not bent or scratches.

4. Inspect general chassis area for neatness of harnesses and wiring, stray sleeving pieces, and rosin or other residue around connections. Check sleeving, where used, for proper size, position, and damage. Remove any metallic scrap found, paying close attention to evidence of metal particles around switches.

5. Check hardware and mounting devices for scratches and burrs, tightness and proper size. Pay especial attention to insulating washer placement. Observe appearance of rubber grommets and mounts; they should be smooth and show no cracking.

INSTRUMENT SHOP

MODEL 10-E

WIRING CHECK

1. This check is for continuity only and the module is not inserted into the basic unit; no program cards are inserted. Set the POLARITY SWITCH in the PNP position.

2. Place the ohmmeter across R205, connected to the red-yellow and white-red-yellow wires. Adjust R205 for minimum resistance.

3. Connect the ohmmeter between the module connector and card connector pins as indicated below. The resistance in each case shall be nearly zero.

MODULE CONNECTOR PIN	CARD CONNECTOR PIN	CIRCUIT
16, 19, or 21	11	Current Supply Positive
13	9	Overload Sense Negative
26	J or 15	Voltage Supply Negative (Note: Ohmmeter Leads may need to be reversed, Diode D201-D is in series this circuit).
49	V	Upper Meter Negative
1	18	Chassis Ground

4. The following module connector pins shall show no shorts to chassis ground: 37, 38, 39, 41, 43, and 44.

5. The following circuits shall NOT indicate a short: Module connector pins 11 and 12; bridge rectifier D201 "AC" terminals (white-violet and white-black-red wires).

6. Connect the ohmmeter from C208- (2000 ufd) to card connector pin 16. A short shall be indicated with the VOLTAGE RANGE switch in the 1 to 30 volt ranges only. Repeat with the ohmmeter connected from C207- (2000 ufd) to card connector pin 17.

MODEL 10-E

PRELIMINARY SET-UP

1. Connect the module to the basic unit with the extender cable and insert the Beta Program Card. Insert the test adapter into the Basic Unit TEST JACKS.

2. Set the controls as follows:

TEST SWITCH	RESET
Basic unit ADJUST controls	Full CCW
Module CURRENT RANGE, Black Marking	0.1 MA
Module VOLTAGE RANGE, Red Marking	1 Volt
Module CURRENT RANGE, Blue Marking	100 MA
POLARITY SWITCH	PNP
Program Card Switch	V_{BE}

3. Turn on and allow to warm up for 3 minutes; adjust the module ZERO control for zero-scale indication on the basic unit LOWER METER.

VOLTAGE POWER SUPPLY

1. Reset the controls to the preliminary setting.

2. Set the multimeter to 2.5 VDC and connect to the collector (-) and base (+) leads of the power transistor test adapter.

3. Set the TEST switch to TEST and turn the LOWER ADJUST control clockwise, observing the multimeter indication. The indication shall be at least 1 volt at the maximum CW position of the LOWER ADJUST control.

4. Repeat step 3 at each position of the VOLTAGE RANGE switch and at black-marking current ranges from .1 to 100. The indicated voltage shall be at least that of the voltage range selected.

5. Repeat step 4 at black-marking current ranges of 300 MA and 1 AMP. The indicated voltage shall be the same as the 30 volt range when the VOLTAGE RANGE selector is in the 100 and 300 volt range positions.

6. Remove the Beta program card and insert the Leakage program card. Set the card switch to I_{EBO} and repeat steps 3 and 4. The voltage indicated shall be at lease that of the voltage range selected for any position of the black-marking current range selector.

7. Remove the leakage card and reset all controls to the preliminary set-up.

MODEL 10-E

VTVM CALIBRATION

1. Connect the lab DC voltmeter between the emitter (+) and base (-) leads of the power transistor test adapter. Adjust the lab voltmeter to read 1 volt.

2. Set the TEST switch to TEST and increase the UPPER ADJUST control until the lab voltmeter reads exactly 1.00 volts.
   Note: If a differentail voltmeter is not used, the internal resistance of a conventional voltmeter will cause the module current meter to read up-scale and the black-marking CURRENT RANGE selector may have to be increased. Do not allow this range to go beyond 100 MA.

3. Adjust R274 (on the module chassis) for full-scale indication on the basic unit LOWER METER.

4. Reset the TEST switch and reconnect the negative lab voltmeter lead to the collector. Set the CARD SWITCH TO V_{CE} and the black-marking current range to 10 MA.

5. Set the TEST switch to TEST and the LOWER ADJUST control for exactly 1.00 volts on the lab voltmeter. The basic unit LOWER METER should read within ± 0.5% of full-scale.

6. Connect the multimeter in place of the lab voltmeter. Set the VOLTAGE RANGE switch and the LOWER ADJUST control for a multimeter voltage indication equivalent to each voltage range. The LOWER METER shall indicate approximately full-scale in each case. This is a check to determine that the voltage divider resistors are wired in proper order.

MODULE CURRENT METER CALIBRATION

1. Reset the controls to the preliminary set-up except that the blue-marking CURRENT RANGE is set to 0.03 MA. Insert the Breakdown card with card switch set to I_{EBO}. Set the lab microammeter to read 30 uamp and connect to the base (+) and emitter (-) of the transistor adapter. Adjust the LOWER ADJUST control until exactly 30.0 uamp is indicated on the lab microammeter.

2. Adjust R253 on the module chassis for full-scale on the MODULE METER.

3. Set the TEST switch to RESET and disconnect the microammeter. Short the base and emitter leads of the adapter. Connect the positive lead of the differential voltmeter to the card connector pin 7 (yellow-orange wire) and the negative lead to ground. The VTVM is set to read 1 volt.

MODEL 10-E

MODULE CURRENT METER CALIBRATION (Cont.)

4. Set the blue-marking CURRENT RANGE switch to the 100 MA position and the TEST switch to TEST. Increase the LOWER ADJUST control until full-scale is indicated on the MODULE METER. The VTVM should read approximately 1 volt.

5. Keeping the setting of the LOWER ADJUST control, check each range of the blue-marking CURRENT RANGE selector; the MODULE METER should indicate approximately full-scale and the VTVM should indicate approximately 1 volt.
   Note: On the 0.01 and 0.03 ranges, the LOWER ADJUST control must be decreased but the two indications should remain the same.

6. Steps 5 and 6 check the meter range and overload sensing range resistors for proper wiring order.

UPPER METER WIRING CHECK

1. Reset the controls to the preliminary set-up; insert the Beta card. Short the emitter and collector leads of the transistor adapter. Connect the differential VTVM positive lead to card connector pin 8 (brown-red wire) and the negative lead to ground.

2. Set the UPPER ADJUST control for approximately full-scale indication on the UPPER METER. The VTVM should be reading approximately 1 volt.

3. Keeping the UPPER ADJUST control setting, check all of the black-marking CURRENT RANGE positions. In each case, the UPPER METER should read about full-scale and the VTVM about 1 volt. This test checks the meter and overload range resistor wiring order.

4. To check the .05 range position, set the UPPER ADJUST control for half-scale on the 0.1 range and depress the .05 button; the UPPER METER shall now read full-scale.

OVERLOAD PROTECTION SENSING PRE-SET VOLTAGE

1. Reset the controls to the preliminary positions. Set the multimeter to read 3 volts DC and connect the positive lead to the center terminal on R205 and the negative lead to the red-yellow wire on R205.

2. Set the TEST switch to TEST and adjust R205 for 3 volts indicated on the multimeter.

MODEL 10-E

OVERLOAD PROTECTION SENSING PRE-SET VOLTAGE (Cont.)

3. Disconnect the multimeter and insert the Breakdown card with card switch in I_{EBO}. Connect the VTVM to card connector pin 7 and ground (as described in step 1 of the UPPER METER check). Short the base and emitter leads of the transistor adapter and short the module meter.

4. Set the blue-marking CURRENT RANGE switch to the .01 position and increase the LOWER ADJUST control until the overload circuit trips. The trip should occur at between 1 volt and 2.5 volts indicated on the VTVM.
   Note: This step checks the overload sensing circuit wiring, but the basic unit overload circuit must be working properly.

OPERATIONAL CHECK

1. Connect a calibrated test transistor and check the current gain.

2. Using the other program cards, check the operation of various parameter tests with the calibrated test transistors.

MECHANICAL ADJUSTMENT

Adjust module latch per Latch Adjustment Instruction B5534.

When complete, sign unit inspection block; mark schematic revision letter on record card. On returned goods, note repair work and calibration done on RGM.

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CHECK OUT PROCEDURE

SPEC. NO. _____
DATE 4/29/63
REV DATE _____
APPROVED _____

MODEL 10-Z

INSTRUMENT SHOP

EQUIPMENT NEEDED

1. BIRTCHER MODEL 70 basic unit
2. 4 foot "cheater" cable with Amphenol 57-10500 connectors
3. 1/2% Lab Type Multimeter
4. Resistance decode box 1Ω to 999K 1/2%
5. Shorting bar for Diode terminals
6. 100 mv/div Oscilloscope

INITIAL TURN ON

1. Place all switches and controls on the Model 70 and the 10 Z module in the counter-clockwise position.
2. Connect Model 10 Z module to MODEL 70 basic unit by means of the cheater cable.
3. Turn on power.
4. Depress TEST switch. All the following measurements should be 1%.

VOLTAGE RANGE SWITCH

1. Place DC Voltmeter across DIODE test jacks on MODEL 70. The positive lead of the voltmeter connects to the jack at the tip of the arrow on the panel.
2. Adjust lower ADJUST knob until upper meter reads full scale. Voltmeter should read 10 volts.
3. Repeat step 2 for 30, 100, & 300 range. Voltmeter should read 30, 100 & 300 volts respectively.

CURRENT RANGE SWITCH

1. Place all controls and switches in the counter-clockwise position.
2. Connect current meter to diode test jack on MODEL 70. The positive lead connects to the jack at the tip of the arrow on the panel.

CURRENT RANGE SWITCH (Cont.)

3. Adjust lower ADJUST knob until lower meter reads full scale. Current meter should read 1 ma.

4. Repeat step 3 for 3, 10, 30 & 100 ma ranges. Current meter should read 3, 10, 30 & 100 ma respectively.

1000 CYCLE OSCILLATOR

1. Place all controls and switches in the counter-clockwise position.

2. Place ossilloscope from pin 3- to pin 4 of T201. A clean sine wave at 1000 cycles ±10% at this point should be adjustable from 0 volts to about 1.2 volts p-p by means of CAL adjustment located on the front panel of the module.

TUNED AC VOLTMETER

1. Set CAL control so AC meter indicates .8 in upper scale.

2. Tune voltmeter by adjusting C219 for maximum reading on the AC meter.

3. Adjust CAL until AC meter reads full scale.

4. Re touch C219 for maximum reading on AC meter.

IMPEDANCE RANGE SWITCH

1. Set all controls and switches in the counter-clockwise position.

2. Place a 10 1/2% resistor between the DIODE test jacks.

3. Switch IMPEDANCE RANGE switch to the 10 position. The AC meter should read full scale.

4. Place a shorting bar between the DIODE test jacks. The AC meter should drop to zero. (Less than 1 division above zero is acceptable.)

5. Repeat steps 1 & 2 for the 30, 100, 300 & 1000 positions using 30, 100, 300, & 1000 1/2% resistors respectively. The AC meter should read 30, 99, 291 & 900 ± 3% respectively. When DIODE jacks are shorted in these switch positions, the AC meter should drop to zero.

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SPEC. NO. _____
DATE 4/29/63
REV DATE _____
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MODEL 10-Z

OPERATION TEST

1. Check all parameters of a calibrated test zener diode at 75 F. DC voltage should measure within ± 1%. AC impedance should measure within ± 2%.

MECHANICAL ADJUSTMENT

1. Adjust module latch per LATCH adjustment instructions B-5534.